# SEARCH FOR HYPERDEFORMATION IN Xe NUCLEI

C. Rønn Hansen[a], G. B. Hagemann[a], B. Herskind[a], D. R. Jensen[a], G. Sletten[a], J. N. Wilson[a], S. W. Ødegård[a,b], P. Bringel[c], C. Engelhardt[c] H. Hübel[c], A. Neusser[c], A. K. Singh[c], G. Benzoni[d], A. Bracco[d], F. Camera[d] S. Leoni[d], A. Maj[e], P. Bednarczyk[f], T. Byrski[f], D. Curien[f], A. Korichi[g], J. Roccaz[g], J. Lisle[h], T. Steinhardt[i], O. Thelen[i], M. P. Carpenter[j], R. V. F. Janssens[j], T. L. Khoo[j], T. Lauritsen[j], R. M. Clark[k], P. Fallon[k]

[a] *The Niels Bohr Institute, Copenhagen, Denmark*

[b] *Dept. of Physics, Univ. of Oslo, Norway*

[c] *ISKP, University of Bonn, Germany*

[d] *Dipartemento di Fisica and INFN, Sezione di Milano, Milano, Italy*

[e] *Niewodniczanski Institute of Nuclear Physics, Krakow, Poland*

[f] *IReS, Strasbourg, France* [g] *CSNSM, Orsay, France*

[h] *University of Manchester, UK*

[i] *Institut für Kernphysik, Universität zu Köln, Germany*

[j] *Argonne National Laboratory, Argonne, USA*

[k] *Lawrence Berkeley National Laboratory, Berkeley, USA*

Two experiments aiming at the identification of hyperdeformed states in Xe nuclei have been performed, first using the Euroball array with its inner BGO-ball and recently Gammasphere where a five times larger data-set using the Atlas accelerator was obtained. The reaction $^{82}$Se($^{48}$Ca,xn)$^{130-xn}$Xe with 195 MeV and 205 MeV bombarding energy, respectively was used. Calculated fission barriers indicate that the compound nucleus is likely to survive fission up to $I = 90\hbar$ and thereby open the possibility to populate hyperdeformed (HD) states at the highest spin in the coldest residual nucleus, $^{126}$Xe. The ultimate cranker calculations (UC) predict a pronounced minimum at $\epsilon \sim 0.9$ with axial symmetry at spins beyond $65\hbar$ in this nucleus. No discrete HD band has been identified in searches on the first dataset, but a ridge structure of 4 $\hbar^2/J^2 \approx 48$ keV was observed [1]. This consists of more than 7 rotational bands with $\approx 5$ transitions in each using both "Rotational Plane Mapping" and the "Fluctuation Analysis" techniques. Also a bump of collective transitions is observed to terminate at an average energy of 2 MeV typical of Jacobi transitions observed in other nuclei[2]. Nevertheless, the most conspicuous feature in the analysis of discrete transitions in $^{126}$Xe is 4 bands extending from about $20\hbar$ to a maximum above 50 $\hbar$ by cascades of transitions with energies extending to 2.5 MeV. A $\triangle E_\gamma$ of $\sim$ 100-120 keV throughout these bands indicate a moderate deformation and may be related to a UC minimum observed at $\epsilon \sim 0.34, \gamma \sim 0°$. An analysis using a filter [3] from 13 transitions of the lowest lying band extending to $I = 52\hbar$, combined with a stepwise condition on the folds of the BGO-ball shows a pronounced bump of feeding transitions with energies in 1.9-2.0 MeV (i.e. considerably lower than the band energies) at the highest folds, also indicating a connection to strongly deformed states in the Jacobi transition region. The new discrete structures may provide a bridge to the regions of extreme deformation. The data from the recent experiment using Gammasphere, presently under analysis, will shed more light on these issues.

[1] B. Herskind et al. Acta Physica Polonica, B34, 2767 (2003)

[2] D. Ward, R.M. Diamond et al., Phys. Rev. C 66, (2002) 024317

[3] J.N. Wilson and B. Herskind, NIM A 455, 612 (2000)